Space Weather Technical Forecast

Issued on Wednesday, 31 August 2022 at 12:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of M-flares (R1-R2 Blackouts). Chance of G1/Minor Storm Day 4 (03 Sep). Slight chance of Active fluence later in the period.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Moderate, with a long period flare from ex-3088 over the limb that peaked at M2.1 at 30/1929 UTC on the Earth-side, with associated far-sided halo CME, that was likely a much stronger flare on the far-side. There are two Earth-sided sunspot regions, with AR3089 Eac/Beta-Gamma-Delta the most prominent. This is a large but currently stable region that has recently traversed into the southwest quadrant. Despite the presence of a persistent delta spot, current magnetic looping appears aligned with little sign of twist or shear. A filament eruption occurred around 30/1500 UTC, to the south of AR3089, and produced a CME that may give a glancing blow at Earth.

Solar Wind / Geomagnetic Activity: Earth is likely moving through an elongated CIR region from CH17/-, but we have also seen the tail end of a CME that gave a glancing impact to the Earth at 29/0245 UTC. Wind speeds showed a brief enhancement to 600-650km/s beginning around 30/1855 UTC, but otherwise speeds mainly around 550 km/s. Density was at or just above average. The total Interplanetary Magnetic Field (IMF) strength Bt, was initially Moderate, but rose to just below 15nT at 30/1855 UTC, before slowly easing to Weak. However the north-south component was mainly positive (northward) peaking 11nT, with brief periods of negative down to -6nT. Phi angle remained negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16, is now at background levels. The high energy electron flux (greater than 2 MeV) remained at background levels. The 24-hour integrated electron fluence remained below the Active threshold (1e8 integrated pfu) with 1.48e6 integrated pfu observed at 31/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Activity is expected to fall to Low with any further flaring from AR3088 over the limb increasingly unlikely to be observed. There is a slight chance, however, of isolated M-flares from AR3089, with a very slight chance of X-flares.

Solar Wind / Geomagnetic Activity: A filament eruption produced a CME which may give a glancing blow at Earth, most likely later on Day 4 (03 Sep). Solar winds are currently elevated to strong, with a gradual decline in wind speeds expected through the next couple of days. Following this we may see some weak influence from CH19/+ on Day 3 (02 Sep), followed by CH20/+. This feature may arrive either later on Day 4 but more likely on Day 5 (04 Sep). Geomagnetic activity is forecast to be Quiet to Unsettled with a declining risk of Active intervals at first, easing to mostly Quiet from Day 2 (01 Sep). This may become Unsettled to Active with a chance of G1/Minor storm intervals on Days 3 or 4, with either the fast wind arrival(s) or from the filament eruption CME.

Energetic Particles / Solar Radiation: High energy protons (greater than 10 MeV) are

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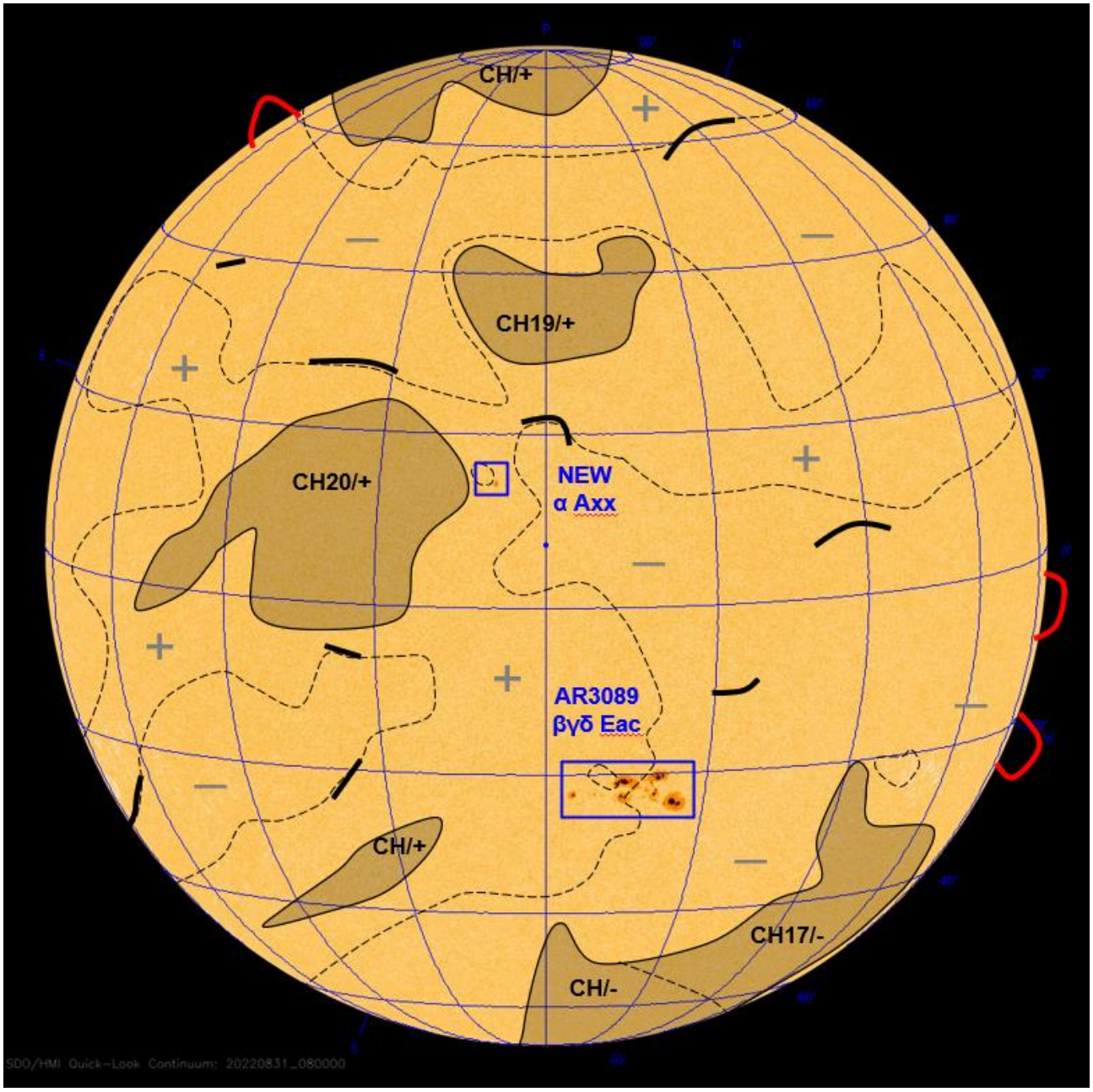
expected to remain below S1/Minor radiation storm levels, but with a slight chance of reaching S1 or above should any significant flares occur from AR2089. The high energy (greater than 2 MeV) electron flux is likely to remain mostly at background levels, but perhaps reaching moderate to high on diurnal peaks as current fast winds ease. The associated 24 hour fluence is likely to remain below the Active threshold, with just a slight chance of peaking above later in the period.

Figure 1. Solar Analysis Valid 31/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption was observed erupting to the south and east of the disc around 30/1500 UTC, with a subsequent CME clearly visible. The bulk of the ejecta will pass behind and below Earth, however a glancing blow is possible from this CME, most likely later on Day 4 (03 Sep). Solar winds are currently elevated to strong as Earth exits the CME from the 29th, which is now considered to have still been influencing the observed winds on the 30th. This was likely due to the CME being caught up in the CIR region around CH17/-, which Earth has also been traversing the northern edge of. A gradual decline in wind speeds is expected through the next couple of days. Following this we may see some weak influence from CH19/+ on Day 3 (02 Sep), but then persistence suggests the arrival of the fast winds of the following coronal hole, CH20/+. This feature is slightly changed from the previous rotation, but may arrive either later on Day 4 but more likely on Day 5 (04 Sep).

Geomagnetic activity is forecast to be Quiet to Unsettled with a declining risk of Active intervals at first, easing to mostly Quiet from Day 2 (01 Sep). This may become Unsettled to Active with a chance of G1/Minor storm intervals on Days 3 or 4, with either the fast wind arrival(s) or from the filament eruption CME.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	1	10	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
31/0204	Partial	Filament	SE quadrant	420	03/1800 UTC	Glancing blow possible

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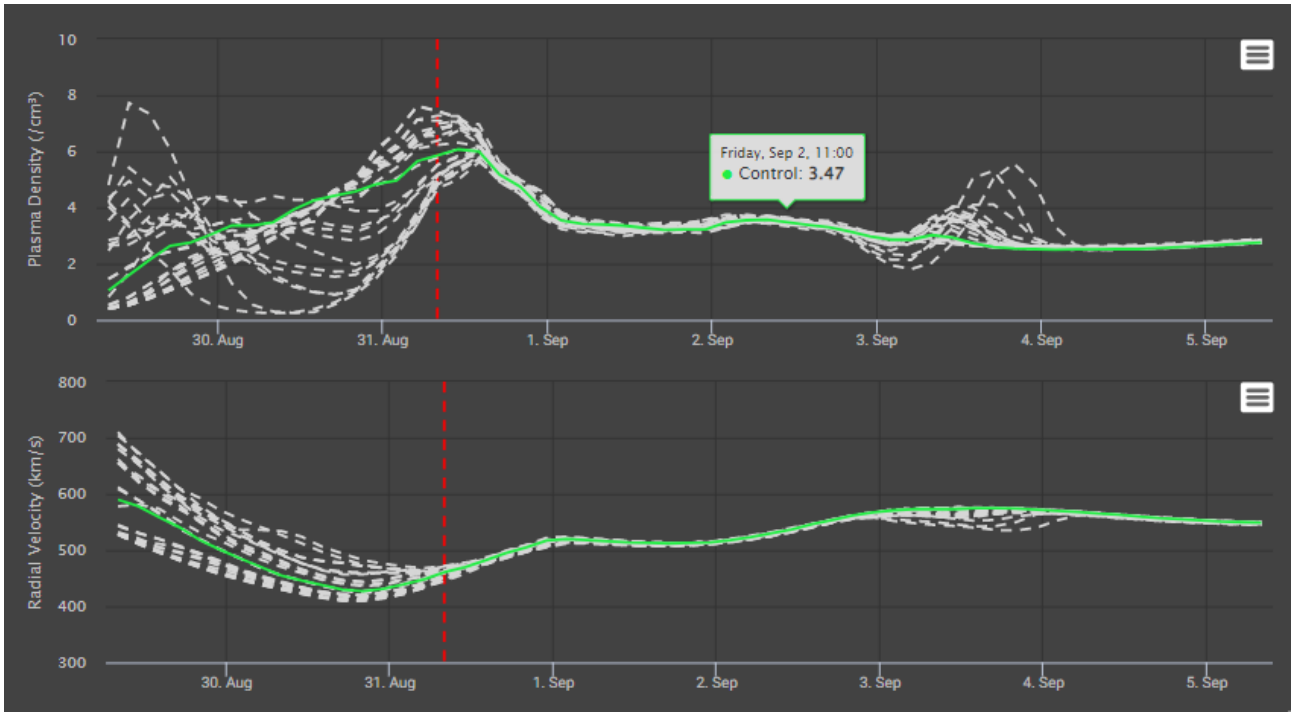
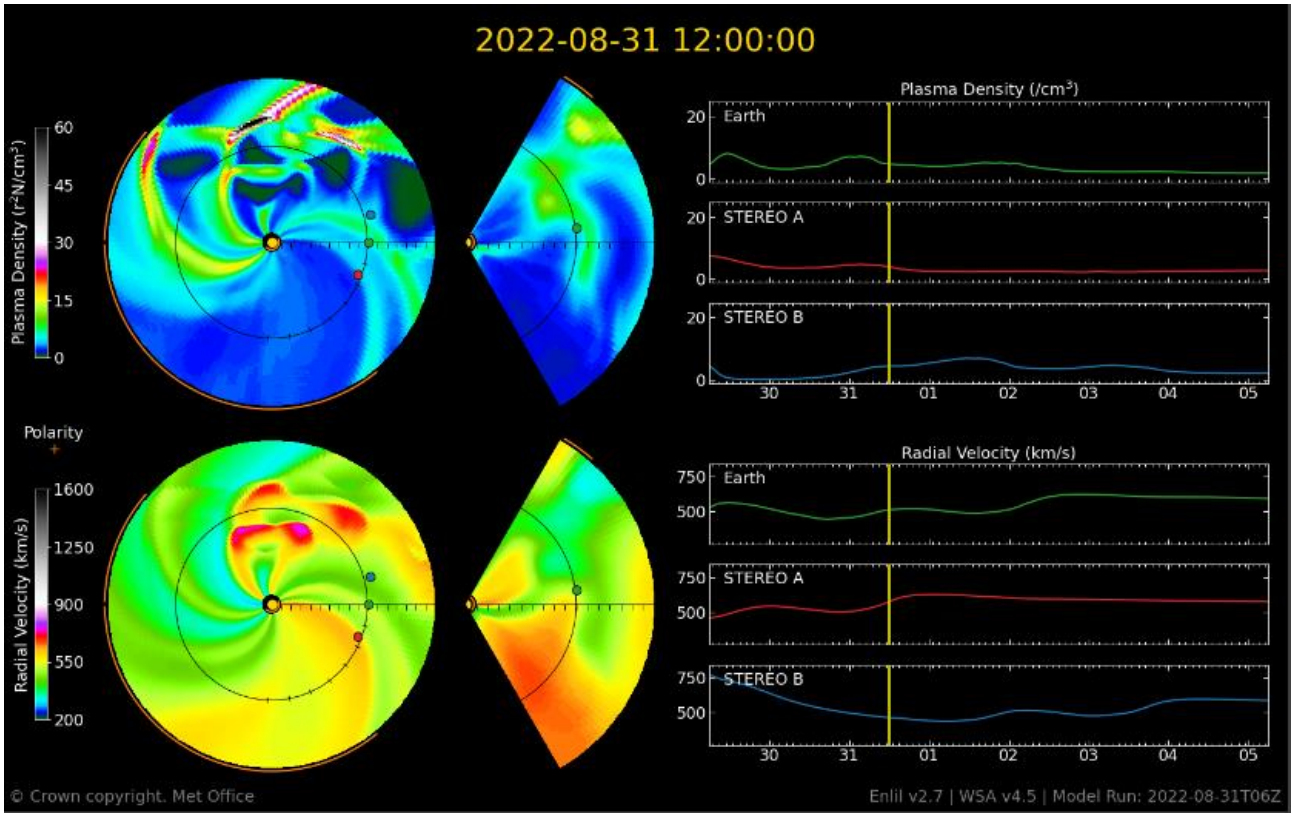
Figure 2: MOSWOC Enlil model and ensemble





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Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate with a long period M-flare observed from ex-3088 over the limb. After the recent large flare, which despite its far-sided location peaked at M2.1 at 30/1929 UTC on the Earth-side, the visible looping of this spot appears to have diminished, with further significant flares from this region now increasingly unlikely.

On the visible disc, the most prominent feature is AR3089 in the south centre disc. This is classified as an Eac/Beta-Gamma-Delta and despite the magnetic arrangement, the looping appears to be organised, with no twisting or other complexities which would suggest any instability or heightened flare risk. This region gives a slight chance of M-class flares and a very slight chance of X-class flaring.

There are also indications on far-side products of a further region rotating on within the next 24 hours, which may also increase flare probabilities although it is difficult to assess any likely increase until it becomes visible.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	20	20	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) is now at background values after recent enhancements. The continued influence of ex-3088 has previously led to a slightly increased possibility of proton events, but this region is now expected to have rotated far enough away to be a significantly reduced risk.

AR3089 (Eac/Beta-Gamma-Delta) despite apparent stability, continues to present a slight chance of a proton event at Earth should there be any significant flaring. This risk will continue as the region rotates across the southwestern quadrant.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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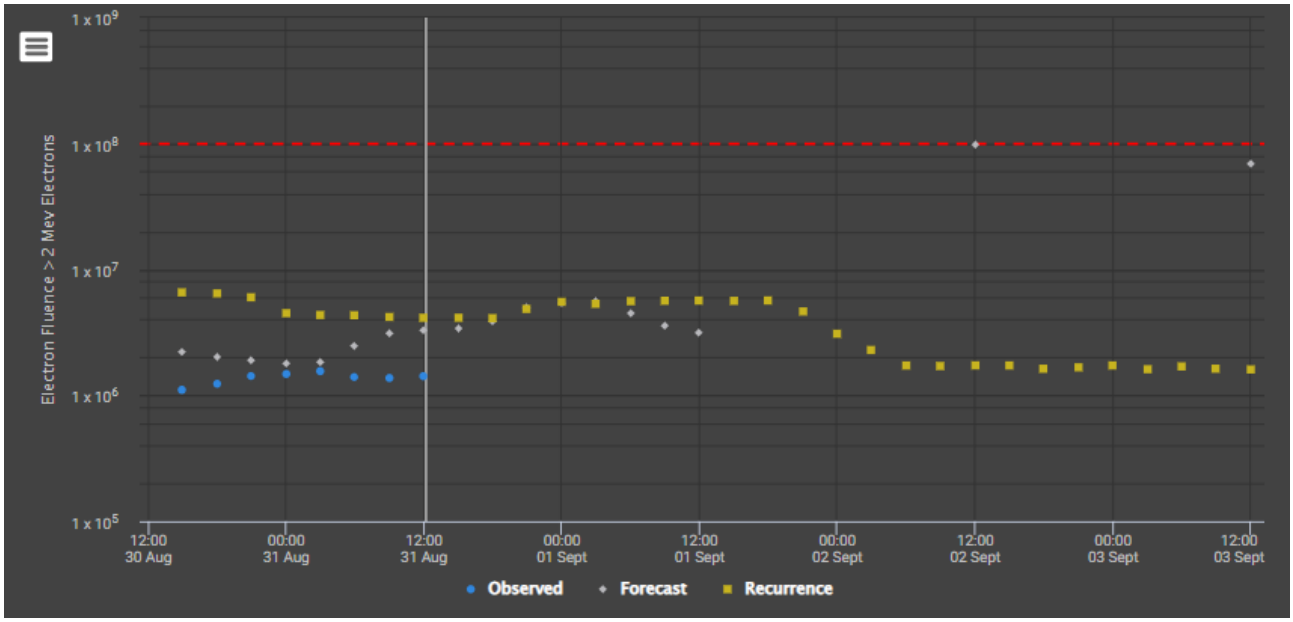
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as measured by GOES-16, is likely to remain near background values through much of the period, but potentially increasing to moderate or brief high values on diurnal peaks later in the period as the current elevated wind speeds ease.

The associated electron fluence is likely to remain below the Active (1e8 integrated pfu) threshold throughout, but with just a slight chance of rising above. REFM is showing a reasonable rising trend, but may be too high with the overall values.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	5	10	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: MOSWOC REFM showing a rising trend.



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